

Application No. 10/797,876
Response dated August 27, 2007
to Office Action mailed April 25, 2007

REMARKS

The Examiner has rejected claims 1-8, 13-16 and 18-20 under 35 U.S.C. § 103(a) as being unpatentable over Hareland et al. U.S. Patent No. 6,909,151 in view of Hiroshi et al. European Patent Application Pub. No. 0684650. Claims 10 and 11 are rejected under § 103(a) as being unpatentable over Hareland et al. in view of Hiroshi et al., and further in view of Christiansen et al. U.S. Patent Application Publication No. 2003/0218189. Claim 17 is rejected under § 103(a) as being unpatentable over Hareland et al. in view of Hiroshi et al., and further in view of Edwards et al. U.S. Patent No. 5,259,881.

The Examiner has indicated that claim 21 is rejected. However, Applicants remind Examiner that Applicants elected claims 1-8, 10-11, and 13-20 for examination in response to Examiner's restriction/election requirement. Please see Applicants' response dated June 9, 2006.

Applicants have added new claim 26. A single crystal silicon and a polycrystalline silicon substrate as recited by claim 26 find support in the specification paragraph [0015]. Hiroshi et al. does not disclose a single crystal silicon or a polycrystalline silicon substrate. In addition to the reasons cited below, Applicants submit new claim 26 is patentable for this reason.

Examination on the merits is respectfully requested for claim 26.

The following remarks are respectfully submitted.

35 U.S.C. §103

Claims 1-8, 13-16, and 18-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,909,151 to Hareland et al. (hereinafter *Hareland*) in view of European Patent Application Pub. No. 0684650 to Hiroshi et al. (hereinafter *Hiroshi*). Of the rejected claims, claims 1 and 20 are independent claims. Applicants disagree with the rejection.

In order to establish a *prima facie* case of obviousness, the Examiner must establish some suggestion, teaching, or motivation to combine the teaching of *Hareland* with that

of *Hiroshi*. Here, however, the Examiner has failed to recite a motivation or suggestion for combining the teachings of the references. One skilled in the art at the time of the invention would not have looked to the teachings of *Hiroshi* in combination with those of *Hareland* to “modify device properties such as flatband voltage and trap charge density to improve device performance.”

In fact, the references actually teach away from their combination. It is improper to combine references where the references teach away from their combination. MPEP §2145 X.D.2. The germanium concentrations disclosed in each reference stand in contrast to one another such that one skilled in the art would not combine the references. On the one hand, *Hiroshi* discloses “the germanium concentration is preferably 20% or higher in terms of mobility. The reason for this is that carriers (electrons or holes) are scattered at the germanium concentration of 20% or lower, *resulting in lowered mobility*”. (emphasis added) (paragraph [0054]) Thus, *Hiroshi* at least suggests that devices having germanium concentrations of 20% or lower do not work for their intended purpose. In addition, *Hiroshi* reinforces his preference for high germanium concentration by stating “in terms of oxidation, it is desirable that the germanium concentration is high.” On the other hand, *Hareland* discloses germanium concentrations of “*less than about 25%*”. (emphasis added) (Col. 3, line 53) Furthermore, *Hareland* discloses a stress film to improve carrier mobility and that greater carrier mobility results in improved device performance. (Col. 2, lines 44-54) Thus, each reference discloses methods for improving device performance by improving carrier mobility. However, they accomplish their respective improved mobility with nearly opposite concentrations of germanium. Therefore, it does not stand to reason that a person of ordinary skill in the art would reasonably expect to succeed in improving carrier mobility by combining the teachings of a reference disclosing high germanium concentrations (preferably 20% or higher), i.e., *Hiroshi*, with the teachings of a reference that discloses “a silicon germanium alloy . . . with less than 25% Ge . . .”, i.e., *Hareland*. The dichotomy in germanium concentration between the two references teaches away from their combination. For at least these reasons,

Applicant respectfully requests that the Examiner withdraw the rejection of independent claims 1 and 20.

Independent claim 1 is patentable for at least one additional reason. To establish a case of *prima facie* obviousness, the prior art references must teach or suggest all the claim limitations. MPEP §2143 With respect to claim 1, the Examiner has noted that “*Hareland* lacks disclosure regarding forming an oxide layer between the high-k dielectric layer and an unreacted portion of the SiGe surface layer, the oxide layer being formed during one or both of said depositing and an annealing process after said depositing.” The Examiner then continues but mischaracterizes *Hiroshi* in an effort to find what *Hareland* is missing.

The Examiner cites Figure 2B and paragraphs [0043-0056] as disclosing “an oxide layer (thermal oxide film SiGeO, 3a) formed between another dielectric layer (second gate insulating film, 11) and an unreacted portion of the SiGe surface layer (2B), the oxide layer being formed during one or both of said depositing and an annealing process after said depositing” as recited in claim 1. However, *Hiroshi* actually discloses forming a thermal oxide film 3a *on* a poly-Si_{0.50}Ge_{0.50} (i.e., a 50% Ge concentration layer) layer 2a (at Col. 8, lines 50-55). The thermal oxide film 3a is not formed *between* the second gate insulating film 11 and the SiGe surface layer 2a because the second gate insulating film 11 is not present at the time the second gate insulating film 11 is formed. *Hiroshi* then discloses forming a silicon nitride film 11 *on* the thermal oxide layer 3a. (Col. 9, line 6-8) *Hiroshi*’s disclosed timing of the formation of both the thermal oxide layer and the silicon nitride film is simply wrong. Consequently, the Examiner has not established a *prima facie* case of obviousness with respect to claim 1. Applicants request that the Examiner withdraw the rejection.

Because claims 2-8, 13-16, and 18-19 depend either directly or indirectly from independent claim 1, Applicant submits these dependent claims are also patentable for at least the same reasons as cited above. Furthermore, each of the dependent claims sets forth a combination of elements and limitations not disclosed or suggested by *Hareland* in view of *Hiroshi*.

With respect to claims 10 and 11, the Examiner has rejected these claims under § 103(a) as being unpatentable over *Hareland* in view of *Hiroshi*, and further in view of Christiansen et al. U.S. Patent Application Publication No. 2003/0218189 (hereinafter *Christiansen*). *Christiansen* does not cure the deficiencies of *Hareland* and *Hiroshi*, as cited above with respect to claim 1, such that each and every element of claims 10 and 11 are not taught or suggested. As there is no *prima facie* case of obviousness, Applicants respectfully request the rejection be withdrawn.

Claim 17 is rejected under § 103(a) as being unpatentable over *Hareland* in view of *Hiroshi*, and further in view of Edwards et al. U.S. Patent No. 5,259,881 (hereinafter *Edwards*). *Edwards* does not cure the deficiencies of *Hareland* and *Hiroshi*, as cited above with respect to claim 1, such that each and every element of claims 17 is not taught or suggested. As there is no *prima facie* case of obviousness, Applicants respectfully request the rejection be withdrawn.

Independent claim 20 is patentable for at least one additional reason. Similar to claim 1, the Examiner cites *Hiroshi* for “teaching annealing by exposing the substrate to an oxygen containing gas (thermal oxidation with nitrogen or oxygen . . .) to form an oxide layer (thermal oxide film, SiGeO, 3a) between the dielectric layer (second gate insulating film 11) and an unreacted portion of the SiGe surface layer.” Once again, the timing of the oxide layer formation is wrong. That is, in *Hiroshi*, the dielectric layer has yet to be formed when the oxide layer is formed. Thus, it is impossible for the oxide layer to form “*between* the high-k dielectric layer and an unreacted portion of the SiGe surface layer,” as recited in claim 20. As with claim 1, the Examiner has not established a *prima facie* case of obviousness with respect to claim 20. Therefore, the Applicants respectfully request the rejection be withdrawn.

In view of the foregoing remarks given herein, Applicants respectfully believe this case is in condition for allowance and respectfully request allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is

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respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Applicants are of the opinion that a one-month extension of time is due with this Response. Payment of all charges due for this filing is made on the attached Electronic Fee Sheet. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

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